

CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

II Semester of M. Sc. (Biochemistry) Examination, May, 2018

Course code & Name BC 761 & Bioenergetics and Metabolism

Date: 07/05/2018 Day: Monday Time: 1.30 PM to 2.00 PM Maximum Marks: 20

MCQ

Important Instructions:

- Tick the correct answer and it should be written in question paper itself.
- Use of non-programmable calculator is allowed.

Q - I	Choose the correct answer for the following questions.		20
1.	The first condition identified as an “inborn error of metabolism” was		01
	(i) Alcaptonuria	(ii) Albinism	
	(iii) Phenylketonuria	(iv) Tyrosinemia	
2.	The key regulatory enzyme of cholesterol synthesis is-		01
	(i) HMG-CoA synthase	(ii) Mevalonate kinase	
	(iii) HMG-CoA reductase	(iv) HMG-CoA lyase	
3.	All are conditions of ketosis except one		01
	(i) Starvation	(ii) Uncontrolled diabetes mellitus	
	(iii) Von Gierke’s disease	(iv) High carbohydrate diet	
4.	Which of the following is a coenzyme in the reaction catalyzed by glyceraldehyde 3-phosphate dehydrogenase?		01
	(i) NAD ⁺	(ii) Cu ⁺	
	(iii) Heme	(iv) ATP	
5.	An enzyme used in both Glycolysis and Gluconeogenesis is:		01
	(i) Glucose 6-phosphatase	(ii) 3-phosphoglycerate kinase	
	(iii) Hexokinase	(iv) Phosphofructokinase-1	

6.	Cellular isozymes of pyruvate kinase are allosterically inhibited by:		01
	(i) High concentrations of Fructose 1,6 bisphosphate	(ii) High concentration of ATP.	
	(iii) High concentrations of AMP.	(iv) Low concentrations of acetyl-CoA.	
7.	The oxidation of 3 mol of glucose by the pentose phosphate pathway may result in the production of:		01
	(i) 3 mol of Pentose, 6 mol of NADPH, and 3 mol of CO ₂	(ii) 2 mol of Pentose, 4 mol of NADPH, and 8 mol of CO ₂	
	(iii) 3 mol of Pentose, 4 mol of NADPH, and 8 mol of CO ₂	(iv) 4 mol of Pentose, 3 mol of NADPH, and 3 mol of CO ₂	
8.	The first few seconds of the 800-meter race will likely feel good to RAJ, but he will find that the length of the event will tax his _____.		01
	(i) glycolytic system	(ii) 1mol ATP/ 1mol PCr	
	(iii) the presence of ADP	(iv) more carbohydrates	
9.	What is the primary substrate used to provide energy at rest?		01
	(i) Glycolytic system	(ii) the use of more carbohydrates	
	(iii) Chemical reaction in the body	(iv) 50% carbohydrates and 50% fats	
10.	What is the primary substrate used to provide energy during high-intensity exercise?		01
	(i) chemical reaction in the body	(ii) 50% carbohydrates and 50% fats	
	(iii) the use of more carbohydrates	(iv) carbohydrate, fat, and protein	
11.	What role does oxygen play in the process of aerobic metabolism?		01
	(i) 32-33mol ATP/ 1 glucose; 100+ATP/ 1 FFA	(ii) is converted from pyruvic acid	
	(iii) inhibits muscle contraction	(iv) helps to breakdown substrates which intern provides more energy	
12.	This system also uses the molecule phosphocreatine to rebuild ATP and maintain a relatively constant supply. The _____ enzyme acts on PCr to separate Pi from creatine. The energy released can then be used to couple Pi to an ADP molecule, forming ATP.		01
	(i) the presence of ADP	(ii) glycolytic system	
	(iii) 1mol ATP/ 1mol PCr	(iv) creatine kinase	
13.	Which of the following is an autoimmune disease?		01
	(i) Sickle cell anemia	(ii) Type 1 Diabetes mellitus	
	(iii) Haemophilia A	(iv) Type 2 Diabetes mellitus	
14.	The following are all characteristics of metabolic syndrome:		01
	(i) Hypertension, hypoglycemia, and high HDL	(ii) Intra-abdominal obesity, hypertension, and low HDL	
	(iii) Dyslipidemia, intra-abdominal obesity, and insulin insensitivity	(iv) Intra-abdominal obesity, hypotension, and low LDLs	
15.	Glucose enters muscle cells mostly by:		01
	(i) Facilitated diffusion using a specific glucose transporter.	(ii) Co-transport with amino acids	
	(iii) Simple diffusion	(iv) Co-transport with sodium	

16.	De novo synthesis of fatty acids occurs in		01
	(i) Mitochondria	(ii) Microsomes	
	(iii) Cytosol	(iv) All of these	
17.	Which of the following substrates derived from adipose tissue contributes to net Gluconeogenesis in mammalian liver?		01
	(i) Glycerol	(ii) Glutamate	
	(iii) Alanine	(iv) Pyruvate	
18.	Spot the inborn error whose early diagnosis is essential to avoid permanent brain damage.		01
	(i) Phenylketonuria	(ii) Glycogen storage disease	
	(iii) Thalassemia	(iv) Diabetes	
19.	What reactions need “activation energy” to get started?		01
	(i) Coupled reactions	(ii) Exergonic reactions	
	(iii) Endergonic reactions	(iv) Endergonic & exergonic reactions	
20.	Biologically, which of the following has the highest redox potential?		01
	(i) Oxygen	(ii) Proteins	
	(iii) Lipids	(iv) Carbohydrates	

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II Semester of M. Sc. (Biochemistry) Examination, May, 2018

Course code & Name BC 761 & Bioenergetics and Metabolism

Date: 07/05/2018 Day: Monday Time: 2.01 PM to 4.30 PM Maximum Marks: 50

Instructions:

1. Section I and II must be attempted in TWO ANSWER SHEET.
2. Make suitable assumptions and draw neat figures wherever required.
3. Use of non-programmable calculator is allowed.
4. Show necessary calculations.

SECTION -I		
Q – II Answer the following questions as directed (Any 5)		20
1.	What are Inborn Errors of Metabolism? What are the different types of inborn errors of metabolism? Discuss briefly.	04
2.	Suppose you discover a mutant yeast whose glycolytic pathway is shorter because of the presence of a new enzyme that catalyzes the reaction glyceraldehyde 3-phosphate + H ₂ O + NAD ⁺ ----> 3-phosphoglycerate + NADH + H ⁺ Although this mutant enzyme shortens glycolysis by one step, how does it affect anaerobic ATP production? Aerobic ATP production?	04
3.	Why is it important to have different pathways for glycogenesis and glycogenolysis in liver and muscle cells? Justify your answer.	04
4.	For the hydrolysis of 1 mole of ATP to ADP at 37 °C, the standard free enthalpy change $\Delta G^0 = -35 \text{ kJ} \cdot \text{mol}^{-1}$. Calculate the free enthalpy change ΔG at the ratio ATP/ADP = 100:1. (Temperature 37°C, R = 8.3143 J K ⁻¹ mol ⁻¹ . Concentrations of water and inorganic phosphate are to be omitted from the equilibrium equation, assuming that they do not change significantly) .	04
5.	What compound acts as an inhibitor of glycolysis? What products are formed when pyruvate undergoes alcoholic fermentation? Is the conversion of pyruvate to lactate an oxidation or a reduction?	04
6.	Calculate the net number of ATPs produced when one 18-carbon fatty acid salt is activated, enters the mitochondrion, and undergoes complete β oxidation. Include the ATP formed from acetyl-CoA in the citric acid cycle, and ATP from all of the reduced coenzymes that are produced.	04
7.	What are the symptoms and treatments of Hyperammonemia?	04

Q-III Answer the following questions as directed (Any 10)		30
1.	The Pentose phosphate pathway is active in liver, adipose tissue, mammary gland. Why this the pathway is less active in non-lactating mammary gland and skeletal muscle?	03
2.	“Acetyl CoA is the gateway molecule for all energy nutrients” –Justify this statement.	03
3.	What is a metabolic disease? How do you recognize a metabolic disorder?	03
4.	What is Cori cycle? How is it differ from Glucose Alanine cycle?	03
5.	What would the result be if both Glycolysis and Gluconeogenesis pathways were operating simultaneously and at the same rate? What is the general term that describes how the situation described earlier in this question can be avoided?	03
6.	What are the causes and treatments of lactic acidosis?	03
7.	Write short notes on Galactosemia.	03
8.	Consider the reaction, $A \rightleftharpoons B + B$, where ΔG° is zero (a) Explain, in general, how entropy may change during the catabolic reaction depicted above. (b) Determine what the sign of the free energy change will be if the concentrations of all the species are raised above the standard conditions by 2-fold. Circle your answer from the three listed, and show your assumptions and equations used to justify your response (A) NEGATIVE (B) NO SIGN / ZERO (C) POSITIVE	03
9.	Write a short note on Tyrosinemia.	03
10.	Why isn't the hexokinase step (STEP 1) the committed step in glycolysis, since it is irreversible and occurs prior to the phosphofructokinase step (STEP 3)?	03
11.	What is the pH inside the matrix of the mitochondrion relative to the intermembrane space? Explain in your answer how the pH is affected during respiration.	03
12.	Reversible phosphorylation is a control mechanism used throughout metabolism. What are the general names of the enzymes involved in reversible phosphorylation and what general reactions do they catalyze?	03
13.	We know that gluconeogenesis is not simply a reversal of glycolysis. Why is this so? In your explanation be sure to mention at least two of the important steps and the enzymes involved.	03